REMARKS

Claims 1, 11, and 25 have been amended herein. Claims 1, 2, 4-6, 8-20, 23-25, 27, and 28 remain pending in the above-identified application.

Applicant acknowledges the allowance or allowability of claims 6, 8-10 and 27.

Section 102(e)

Applicant respectfully requests reconsideration of the rejection of claims 1, 2, 11-16, 18, 23-25, and 28 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,319,742 (Hayashi).

Claims 1, 2, 11-16, and 18

As amended, each of claims 1, 2, 11-16, and 18 recites a method of manufacturing a crystal of a III-V compound of a nitride system including growing a crystal of a III-V compound of the nitride system having a predetermined thickness on a surface selected from a group of surfaces consisting of a surface of a basal body and a surface of a base layer, wherein the growth step includes **forming a first nitride pattern in one position in the crystal in a direction of a thickness of the crystal**, the first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to said lateral direction and each of the first elements having at least one width measured in the lateral direction, **depositing an intermediate layer directly on a surface of the first pattern**, and **forming a second nitride pattern in another position in the crystal in the direction of the thickness of the crystal directly on a surface of said intermediate layer**, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the pitch of said first pattern and the pitch of said second pattern are different, and wherein the second pattern partly overlies and partly does not overlie said first pattern in the

direction of the thickness of the crystal due at least in part to the different pitches of the first pattern and the second pattern.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO_2 film layers 30, and another GaN layer 24. *See* Fig. 13. Hayashi does not disclose a method of manufacturing a crystal of a III-V compound of a nitride system including growing a crystal of a III-V compound of the nitride system having a predetermined thickness on a surface selected from a group of surfaces consisting of a surface of a basal body and a surface of a base layer, wherein the growth step includes forming a first nitride pattern in one position in the crystal in a direction of a thickness of the crystal, the first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to said lateral direction and each of the first elements having at least one width measured in the lateral direction, depositing an intermediate layer directly on a surface of the first pattern, and forming a second nitride pattern in another position in the crystal in the direction of the thickness of the crystal directly on a surface of said intermediate layer, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the pitch of said first pattern and the pitch of said second pattern are different, and wherein the second pattern partly overlies and partly does not overlie said first pattern in the direction of the thickness of the crystal due at least in part to the different pitches of the first pattern and the second pattern.

The Office Action and the Advisory Action assert that the SiO_2 film 30 of Hayashi is equivalent the claimed first nitride pattern and the current blocking layer 31 of Hayashi is equivalent to the claimed second nitride pattern. However, the current blocking layer 31 of Hayashi is not formed directly on a surface of an intermediate layer that is deposited directly on a surface of the first pattern. Instead, the current blocking

layer 31 is part of a device 36, which is formed above the crystal. Specifically, the current blocking layer 31 of Hayashi is formed directly on a cladding layer 29, which is in turn formed directly on an active layer 28. The device 36 formed on the crystal further includes three additional layers 27, 26, 25 formed beneath the active layer 28. Thus, there are multiple layers (i.e., six layers shown in Fig. 13) separating the current blocking layer 31 and the first pattern 30. The method of forming a device of Hayashi is markedly different than the claimed method including forming a first nitride pattern, depositing an intermediate layer directly on a surface of the first pattern, and forming a second nitride pattern directly on a surface of the intermediate layer.

In addition, the current blocking layer 31 of Hayashi is not part of the crystal, which Hayashi refers to as the nitride based semiconductor layer. *See e.g.*, column 14, lines 14-21. Various embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action and the Advisory Action refer to, shows the crystal positioned below a semiconductor device, namely a laser device. *See* column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. *See e.g.*, specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer…" (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. *See* page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. *See e.g.*, Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the analogy of the

first and second nitride patterns in Hayashi are the recesses and projections topped by the SiO_2 film 30. *See e.g.*, column 12, lines 21-29. However, these recesses and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

Because the reference does not disclose every feature of the claims, the rejection is improper. Accordingly, Applicant respectfully requests the rejection be withdrawn.

Claims 23, 24, and 28

Claims 23, 24, and 28 recite a method of manufacturing a device by **forming a device film on a surface of one of a crystal substrate and a crystal film**, the method comprising **forming one of the crystal substrate and the crystal film by growing a crystal** of a III-V compound of a nitride system having a thickness on a surface of a basal body, and **forming the device film on one of the crystal substrate and the crystal film**, the device film having a light-emitting portion including a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer, wherein **the growth step includes forming a first pattern** including a plurality of first elements distributed in a lateral direction with respect to the crystal in at least one pitch, the first pattern being formed in one position in the crystal in a direction of the thickness of the crystal, each of the first elements having at least one width measured in the lateral direction, and **the growth step includes forming a second pattern** including a plurality of second elements distributed in the lateral direction in at least one pitch, the second pattern being formed in another position in the crystal in the direction of the thickness of the crystal, each of the second elements having at least one width measured in the lateral direction, wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal, and wherein the light-emitting portion overlies a region of the crystal where the second pattern overlies the first pattern

so that dislocations that may form in the crystal adjacent the basal body generally do not reach the light-emitting portion.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO_2 film layers 30, and another GaN layer 24. *See* Fig. 13. Hayashi does not disclose a method of manufacturing a device by forming a device film on a surface of one of a crystal substrate and a crystal film, the method comprising forming one of the crystal substrate and the crystal film by growing a crystal of a III-V compound of a nitride system having a thickness on a surface of a basal body, and forming the device film on one of the crystal substrate and the crystal film, the device film having a light-emitting portion including a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer, wherein the growth step comprises forming a first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal in at least one pitch, the first pattern being formed in one position in the crystal in a direction of the thickness of the crystal, each of the first elements having at least one width measured in the lateral direction, and forming a second pattern including a plurality of second elements distributed in the lateral direction in at least one pitch, the second pattern being formed in another position in the crystal in the direction of the thickness of the crystal, each of the second elements having at least one width measured in the lateral direction, wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal, and wherein the light-emitting portion overlies a region of the crystal where the second pattern overlies the first pattern so that dislocations that may form in the crystal adjacent the basal body generally do not reach the light-emitting portion.

Regarding claims 23, 24, and 28, the Office Action and the Advisory Action maintain that the SiO_2 film 30 of Hayashi is equivalent the claimed first nitride pattern and the current blocking layer 31 of Hayashi is equivalent to the claimed second nitride pattern. However, the claims recite forming a device film on one of a crystal substrate

and a crystal film, which crystal structure is formed by growing a crystal including forming the first pattern and forming the second pattern. **Thus, the device film is formed above the first and the second patterns of the crystal.** As claimed, the device film has a light-emitting portion including a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer. **Thus, according to the claimed method, the first pattern and the second pattern are formed below each of the cladding layer, the contact layer, and the electrode.** The Office Action and the Advisory Action, referencing Fig. 13 of Hayashi, identifies a cladding layer 25, a contact layer 33, and an electrode 34. However, the current blocking layer 31, which the Office Action and Advisory Action assert is equivalent to the claimed second pattern, is formed *above* the cladding layer 25 and *above* the contact layer 33. Accordingly, the device film 36 of Hayashi including the cladding layer 25 and the contact layer 33 is not formed above the crystal including the first pattern and the second pattern, as claimed.

In addition to the reasons stated in the immediately preceding paragraph, the current blocking layer 31 of Hayashi does not qualify as the claimed second pattern of the crystal because the current blocking layer is part of the device 36, which is formed on the crystal, and is not part of the crystal as claimed. However, the claimed second pattern is formed as part of the crystal, which is formed *below* the device including the claimed layers and electrode. Various embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action and the Advisory Action refer to, shows the crystal positioned below a semiconductor device, namely a laser device. *See* column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. *See e.g.*, specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer…" (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. *See* page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. *See e.g.*, Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the analogy of the first and second nitride patterns in Hayashi are the recesses and projections topped by the SiO_2 film 30. *See e.g.*, column 12, lines 21-29. However, these recesses and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

Because the reference does not disclose every feature of the claims, the rejection is improper. Accordingly, Applicant respectfully requests the rejection be withdrawn.

Claim 25

As amended, claim 25 recites a method of manufacturing a crystal comprising **growing a crystal wherein the growth step includes forming a first pattern in one position in the crystal** in a direction of a thickness of the crystal including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and **the crystal growth step includes forming a second pattern in another position in the crystal** in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of

the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, **wherein the crystal is substantially free of an active layer between the first pattern and the second pattern**, wherein the width measured in the lateral direction of at least one of the first pattern elements is different than the width measured in the lateral direction of at least one of the second pattern elements, and wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different widths.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride-based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO_2 film layers 30, and another GaN layer 24. *See* Fig. 13. Hayashi does not disclose a method of manufacturing a crystal comprising growing a crystal wherein the growth step includes forming a first pattern in one position in the crystal in a direction of a thickness of the crystal including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and the crystal growth step includes forming a second pattern in another position in the crystal in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the crystal is substantially free of an active layer between the first pattern and the second pattern, wherein the width measured in the lateral direction of at least one of the first pattern elements is different than the width measured in the lateral direction of at least one of the second pattern elements, and wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different widths.

Regarding claim 25, the Office Action and Advisory Action maintain that the SiO_2 film 30 of Hayashi is equivalent the claimed first nitride pattern and the current blocking layer 31 is equivalent to the claimed second nitride pattern. However, the device of Hayashi includes an active layer 28 between the SiO_2 film 30 and the blocking layer 31. *See* column 13, lines 58-65 and Fig. 13. Accordingly, the Hayashi does not disclose forming a crystal including forming a first pattern and forming a second pattern wherein the crystal is substantially free of an active layer between the first pattern and the second pattern.

In addition, the current blocking layer 31 is not part of the crystal, which Hayashi refers to as the nitride based semiconductor layer. *See e.g.*, column 14, lines 14-21. Various embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action and Advisory Action refers to, shows the crystal positioned below a semiconductor device, namely a laser device. *See* column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. *See e.g.*, specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer…" (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. *See* page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. *See e.g.*, Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the analogy of the claimed first and second nitride patterns in Hayashi are the recesses and projections topped by the SiO_2 film 30. *See e.g.*, column 12, lines 21-29. However, these recesses

and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

Because Hayashi does not disclose all of the features of claim 25, the rejection is improper. Accordingly, Applicant requests that the rejection be withdrawn.

Section 103(a) - Hayashi

Applicant respectfully requests reconsideration of the rejection of claims 4 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi. The rejection is improper because claims 4 and 5 depend from claim 1, which was improperly rejected as shown above, and the reference also does not suggest the previously noted elements.

Section 103(a) - Hayashi in view of Fleming

Applicant respectfully requests reconsideration of the rejection of claims 17 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi in view of U.S. Patent No. 6,358,854 (Fleming). The rejection is improper because claims 17 and 19 depend from claim 1, which was improperly rejected as shown above, and the secondary reference does not provide or suggest the previously noted elements.

Section 103(a) - Hayashi in view of Major

Applicant respectfully requests reconsideration of the rejection of claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi in view of U.S. Patent No. 5,689,123 (Major). The rejection is improper because claim 20 depends from claim 1, which was improperly rejected as shown above, and the secondary reference does not provide or suggest the previously noted elements.

Conclusion

As it is believed that the application is in condition for allowance, a favorable action and a Notice of Allowance are respectfully requested.

If the Examiner desires, Applicant welcomes a telephone interview to expedite prosecution.

Respectfully submitted,

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